

TRANSFORMATION OF FARMING LANDS IN THE ZONE OF PERMISSIBLE RADIOACTIVE CONTAMINATION

Presentation of the problem. Under modern conditions of the high anthropogenic and agrarian pressure on the environment, the transformation of farming lands and agricultural areas is an essential instrument in the process of the formation of ecologically balanced land-use. The plowing-up of farm lands exceeds 1.6 times the ecologically justified level in the Polissya part of the Zhytomyr oblast and 1.5 times – in the zone of permissible radioactive contamination. The discrepancy between the necessity of expanding the portion of arable lands as the most productive ones in the structure of farming lands at intrafarm level and the balanced ratio between plowland and ecologically balanced lands – forests, native meadows and pastures at interfarm, regional levels is one of the fundamental problems of the organization of the economically expedient and ecologically balanced structure of farming lands and agricultural areas. Out of twenty three districts of the Zhytomyr oblast, seven of them are distinguished by peak values of Cs-137 and Sr-90 content, and this amounts to 698 settlements in which 348,000 people live and 396 agroformations, including 117 farm enterprises, function. A special regime of economic activities in the zone of permissible radioactive contamination has called for the necessity of determining differences between the processes of transformational restructuring of agricultural lands at oblast and regional levels.

Analysis of the latest research and published works. The problems of the rational use and protection of land resources, agrolandscape safety, methodology of land use optimization on the radionuclide contaminated territory have been discussed in their works by the researchers of the Institute of Agriculture of the NAAS A. Melnychuk, A. Bovsunivsky, O. Savchuk, O. Vlasenko, G. Nalapko and others. The formation of ecologically stable and highly productive agrolandscapes has been studied by S. Bulyghin, V. Buryakov and M. Kotova [1]. Practical experience of A. Tretyak and M. Shkvar [2] can be considered the most significant for the assessment of ecological stability of agrolandscapes and agricultural land-use. Among foreign authors of scientific papers concerning ecologically balanced land-use we can mention V. Frolov [3], S. Volkov [4], N. Chepurnykh [5], M. Sulyn and others.

Setting of the task. The purpose of the article is the determination of ecological and economic trends in the transformation of farm lands of the Zhytomyr oblast and the zone of permissible radioactive contamination.

Statement of the basic material of the research. The present-day state of using land resources in the Polissya zone does not meet the requirements of rational nature management. The original nature-and-landscape characteristics of the region in combination with substantial territories which suffered from Chernobyl-derived radioactive contamination are being even more complicated by socio-economic consequences of the post-accident period. The ecologically permissible ratio between the area of plowland and forests as well as that of natural forage lands has been disrupted. The plowing-up of farm lands in the Polissya part of the Zhytomyr oblast is the highest among similar indices concerning forest zones of European countries. The necessity of transforming agricultural lands is, in our opinion, conditioned by the factors which may be of external or internal origin (Fig.1).

Part of the above factors has a natural character, and they are uncontrolled or little-controlled; the other part is called for the enhancement of economic efficiency of land resource use, solution of problems connected with excessive agricultural land development, soil dehumification, expansion of erosion processes, deterioration of agrochemical soil properties and others. For complete reflection of transformational land-use processes on a farm or land resource use at sectoral or macroeconomic level, it is necessary to take into account both changes in the structure of agricultural lands and actual change of their area.

Within 2008-2012 as many as 13.3 thous ha of farming lands in the Zhytomyr oblast were withdrawn from economic turnover. Out of them 12.03 thous ha (90.4%) are located in the zone of permissible radioactive contamination. As a result, the level of the territory's agricultural development has been improved, but against the background of the reduction in the area of farming lands, their transformation has taken place. The tillage area in the structure of agricultural lands has increased by 2.5 percent in the zone of permissible radioactive contamination and by 1.6 percent at oblast level (Table 1).

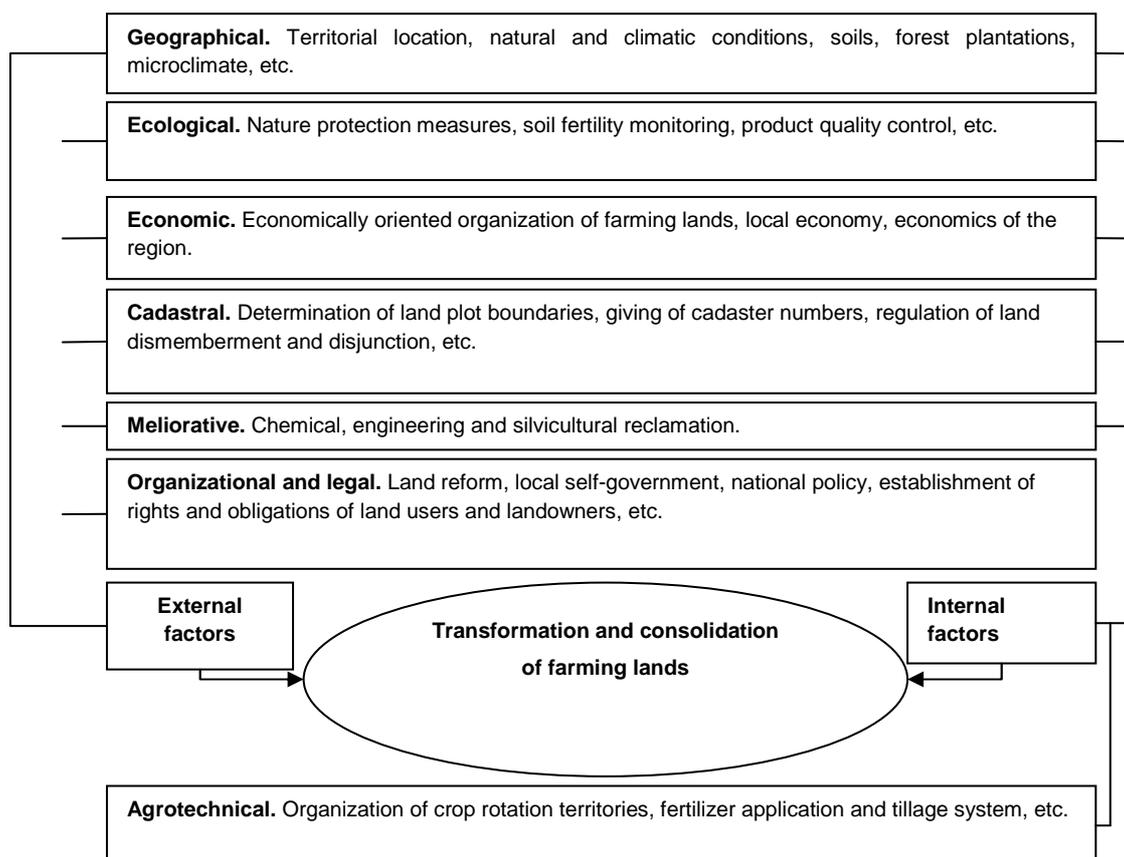


Fig. 1. Logical and significant model of the factors of reorganizing lands of agricultural enterprises.

Source: the author's development

Table 1. Transformation of Zhytomyr region's farm lands and the zone of permissible radioactive contamination.

Type of lands	Year					
	2008	2009	2010	2011	2012	2012 +- 2008
1	2	3	4	5	6	7
Transformation of lands in Zhytomyr oblast, %						
Plowland	70,92	71,58	71,54	71,56	72,54	+1,62
Fallows	6,46	5,87	6,09	6,10	5,13	-1,33
Perennial plantations	1,52	1,52	1,53	1,54	1,54	+0,02
Haylands	8,56	8,56	8,47	8,42	8,42	-0,14
Pastures	12,54	12,47	12,37	12,37	12,38	-0,16
Transformation of lands in the zone of permissible radioactive contamination, %						
Plowland	63,35	63,42	63,68	63,94	65,87	+2,52
Fallows	6,19	6,21	6,40	6,25	4,31	-1,88
Perennial plantations	1,10	1,11	1,15	1,15	1,15	+0,05
Haylands	14,47	14,44	14,24	14,11	14,05	-0,41
Pastures	14,89	14,82	14,54	14,55	14,61	-0,28
Area of arable lands, ha						
Oblast	1083524	1092837	1085285	1084452	1098677	+15153
Zone	275523	275522	270631	270728	278681	+3158

Source: personal research

The increase in the share of plowland has, primarily, taken place at the expense of the reduction in the share of fallows. Over the period of 2008-2012 the area of fallows in the oblast decreased from 986,628 to 77,673 ha, or by 21.2 percent, which in the structure of farm lands amounted to 1.33 percent. Similarly, in the

zone of permissible radioactive contamination the area of fallows in the structure of farm lands decreased from 26,917 to 18,231 ha, or by 1.88 percent.

The lesser part of lands transferred to plowland were occupied by pastures. The area of corresponding lands decreased from 191,608 in 2008 to 187,489 ha in 2012. The area of haylands decreased from 130,800 to 127,518 ha at oblast level, and from 62,918 to 59,463 ha at the level of the zone of permissible radioactive contamination. The area under perennial plantations remained almost unchanged -- 23,197 ha in 2008 and 23,263 ha in 2012 at oblast level, and 4,806 – 4,884 ha in 2008 and 2012 respectively in the zone of permissible radioactive contamination. Thus, the transformation of farm lands at oblast level had the following form:

- 1) at the expense of fallows the share of plowland increased by 82.1 percent (+12,440.6 ha);
- 2) at the expense of haylands the share of plowland increased by 8.6 percent (+1,303.2 ha);
- 3) at the expense of pastures the share of plowland increased by 9.9 percent (+1,500.1 ha).

The maximum deviation at the expense of the share of perennial plantations may amount to 1.2 percent (181.8 ha).

The transformation of farm lands in the zone of permissible radioactive contamination:

- 1) at the expense of fallows the area of plowland increased by 74.6 percent (+2,356 ha);
- 2) at the expense of haylands the share of plowland increased by 16.3 percent (514.7 ha);
- 3) at the expense of pastures the share of plowland increased by 11.1 (+350.5 ha).

The maximum deviation at the expense of the share of perennial plantations may amount to 1.98 percent (62.5 ha).

The escalation of anthropogenic load on the environment and artificially understated significance of ecological factors inherited from the administrative-command system have stipulated the excess of the ecologically justified level of farm land plowing-up in the Zhytomyr oblast and in the zone of permissible radioactive contamination.

According to scientifically justified standards, the plowing-up of farm lands within the limits of 60-80 percent is unfavourable, 25-60 percent – conditionally favourable, 25 percent and lower is favourable. The share of plowland at the level of 50 percent may be considered optimal [6,7]. In accordance with the concept of adapted-to-landscape land resource use, the relationship between destabilizing (plowland) and stabilizing (meadows and pastures) lands in the Zhytomyr oblast's agrolandscape is to be 1:1.2, particularly in the Polissya zone –1:1.2, transition zone –1:1.16 and Forest steppe –1:0.8. Accordingly, the ecologically justified plowing-up of farm lands in the Zhytomyr oblast's Polissya zone, including the zone of permissible radioactive contamination, may be assumed as 50 percent, and 40 percent on average in the oblast (Fig.2).

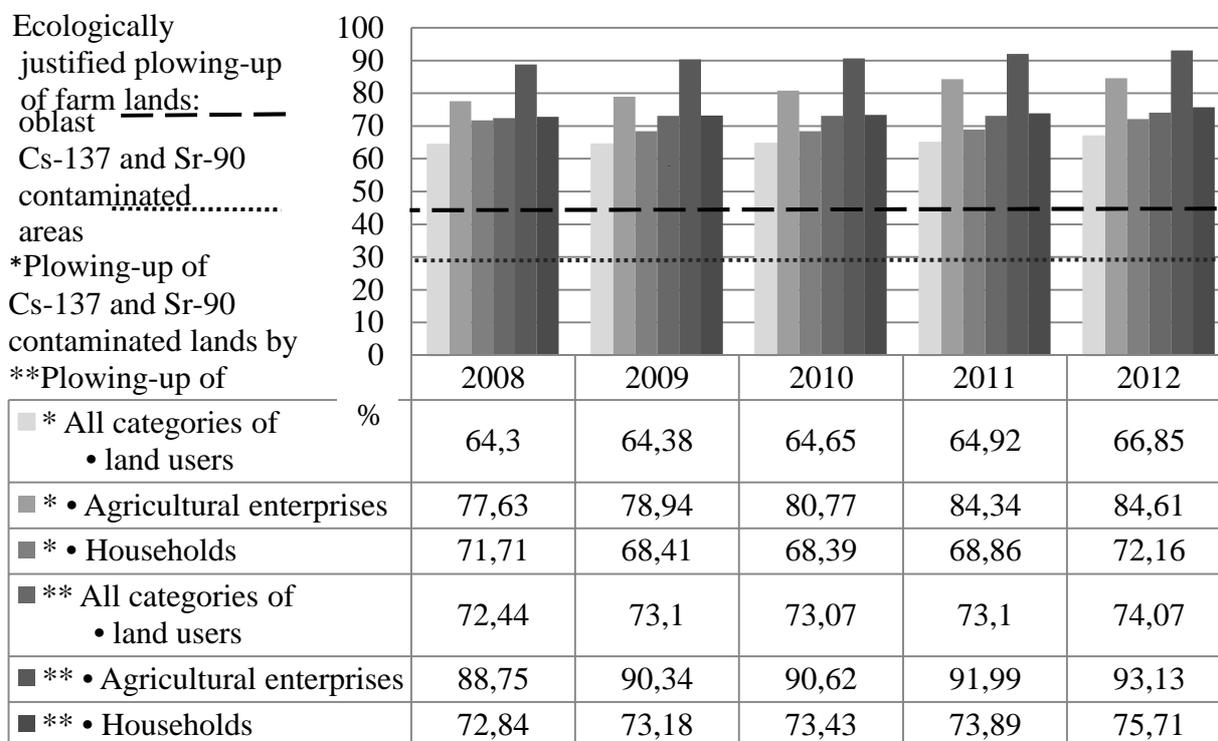


Fig.2. Plowing-up of farm lands in the Zhytomyr oblast and in the zone of permissible radioactive contamination.

Source: personal research

The level of plowing-up of the Zhytomyr oblast's land fund as on January 1st, 2012 amounted to 37.6 percent:

-- in the Polissya zone (783.6 thous ha of farm lands or 49.4 percent of the oblast's territory) the plowing-up of land fund made up 30.4 percent and that of the agrolandscape – 59.43 percent;
 -- in the Forest steppe zone (457.1 thous ha of farm lands or 28.8 percent of the oblast's territory) the plowing-up of the land fund was 68.2 percent and that of the agrolandscape – 84.37 percent;
 -- in the transition zone (347.0 thou ha of farm lands or 21.09 percent of the oblast's territory) the plowing-up of the land fund amounted to 86.2 percent and that of the agrolandscape – 45.5 percent.

Despite the increase in the share of arable lands in the ecologically unbalanced territorial structure, to which the Zhytomyr oblast belongs, and in the zone of permissible radioactive contamination (PRC) where one of the guarantors of turning out farm products complying with the permissible levels of 2006 is a high level of farming, the main economic indices show rising dynamics (Table 2).

Table 2

Aggregative indices of economic effectiveness of land resource use.

Region	Gross output per 100 ha, thous. hr			Землевіддача			2012 +- 2010,%
	2010	2011	2012	2010	2011	2012	
1	2	3	4	5	6	7	8
Zhytomyr oblast	418,2	476,6	524,6	0,35	0,40	0,44	+25,7
incl. the zone of PRC	297,1	310,6	346,9	0,50	0,52	0,58	+16,0

Source: personal research

During the last years the aggregate agricultural production yield per one unit of area in physical and monetary terms has been growing in the Zhytomyr oblast. The grain crop yield in the oblast indicated has grown from 29.4 to 43.5 centners per ha, and in the zone of permissible radioactive contamination – from 15.8 to 23 centners per ha. The increment in gross production over the three-year period amounted to 26 percent at oblast level and 16 percent at the level of the districts ascribed to the zone of permissible radioactive contamination. Thus, one can note the dynamics of the growth of economic indices of land resource use; however, taking into account the increase in the share of arable lands, this is taking place by extensive way.

Conclusions from the given research. To bring the Zhytomyr Polissya's agrolandscape to the ecologically justified structure, it is necessary to withdraw and transfer 191.1 thous ha of plowland to stabilizing lands, as many as 102.1 thous ha of them in the zone of permissible radioactive contamination. The most expedient way to put into practice such transformations is the organization of landholding and land-use on adapted-to-landscape principles. This approach makes it possible to improve land-use conditions in the Zhytomyr oblast, where a characteristic feature is a great number of soil differences with their frequent rotation on relatively small plots of land (soil cover variety), and on the territories which suffered from radioactive contamination, where soil cover variety is even more complicated by the spotty character of land contamination with Cs-137 and Sr-90. The changes in the structure of agricultural lands on this basis are called for the transfer of the modern system of land resource use to the resource-saving foundation, within the limits of which the further intensification of land resource use is to take place.

References

- 1) Bulyhin, S.Yu., Burakov, V.I., Kotova, M.M., Novak, B.I., Achasov, A.B., Barvynskiy, A.V. (2004), *Proektuvannia gruntozakhysnykh ta melioratyvnykh zakhodiv v ahrolandshafta* "Design of soil and reclamation activities in agricultural landscapes", Natsionalnyi ahrarnyi universytet, Kyiv, Ukraine, 114 p.
- 2) Tretiak, A.M., Tretiak, R.A. and Shkvar, M.I. (2001), *Metodychni rekomendatsii otsinky ekolohichnoi stabilnosti ahrolandshaftiv ta silskohospodarskoho zemlekorystuvannia* "Methodical recommendations of environmental sustainability assessment of agricultural land and agricultural landscapes", In-t zemleustroi UAAN, Kyiv, Ukraine, 15 p.
- 3) Frolov, V.I. (2011), *Metody obosnovaniya programm ustoychivogo rozvitiya selskikh territoriy* "Methods of sustainable development justification of the rural areas", monograph, SPb. gos. arkhiv.-stroit. un-t., St.-Peterburg, Russia, 464 p.
- 4) Volkov, S.N. (2001), *Zemleustroystvo: v 3-kh t, T. 2 : Zemleustroitelnoye proyektirovaniye. Vnutrikhozyaystvennoye zemleustroystvo* "Land management: 3 Vols. - Volume 2: land use planning. farm boundary", textbook, Kolos, Moscow, Russia, 648 p.
- 5) Chepurnykh, N.V., Novoselov, A.V. and Merzlov, A.V. (2006), *Regionalnoye rozvitiye: selskaya mestnost* "Regional development: rural territory", Nauka, Moscow, Russia, 384 p.
- 6) Sulyn, M.A. (2002), *Zemleustroystvo selskokhozyaystvennykh predpriyatiy* [Land management of agricultural enterprises], tutorial, izdatelstvo "Lan", St.-Peterburg, Russia, 224 p.
- 7) Sokhnych, A.Ya. and Tibilova, L.M. (2006), "Landscape and environmental aspects of land management", *Ekonomika APK*, no. 5, pp. 27-28.

8) Prymak, I.D., Manko, Yu.P., Ridei, N.M., Mazur, V.A., Horshchar, V.I., Konoplov, O.V., Palamarchuk, S.P., Prymak, O.I. (2010), *Ekolohichni problemy zemlerobstva* [Environmental problems of agriculture], Kyiv, Ukraine, 456 p.

Buhaichuk O. TRANSFORMATION OF FARMING LANDS IN THE ZONE OF PERMISSIBLE RADIOACTIVE CONTAMINATION

Purpose. The aim of the paper is to determine the ecological and economic trends in the transformation of Zhytomyr region agricultural lands, including the areas classified as zone of acceptable radioactive contamination.

Methodology of research. To achieve the objectives of the publication following methods of economic research were applied: 1) the dialectical method - to determine the subject of the study, to draw conclusions and proposals; 2) the method of induction - to find possible ways to enhance the ecological balance of the Zhytomyr region and the zone of acceptable radioactive contamination; 3) the method of deduction - to determine the main reasons that led to an imbalance that is specified previously; 4) a graphical method - to determine scientifically justified level of arable land in territorial structures; 5) the method of analytical calculations - for the analysis of business entities in area classified as zone of acceptable radioactive contamination and Zhitomir region; 6) economic - mathematical method to determine the prospects for a transition of land use on the sustainable basis.

Findings. To bring the agrolandscape of the Zhytomyr Polissya to environmentally sound structure should be removed and put in stabilizing land 191.1 thousand hectares of arable land, of which in the area of acceptable radioactive contamination is 102.1 thousand hectares. The most feasible through such transformation is to organize land tenure on adaptive - landscape principles. This approach can improve the ecological - economic indicators of land use in the Zhytomyr region and in areas affected by radioactive contamination.

Originality. Scientific novelty of the paper is in the theoretical - methodological substantiation of the agro landscape features Zhytomyr region and the zone of radioactive contamination in the current economic conditions.

Practical value. Economic activities in the environmentally balanced territory in conjunction with the observance of a scientifically based system of agriculture - is the only way to increase the economic efficiency of land use. This article seeks to cover the environmental problems caused by overloading agricultural areas and areas of Zhytomyr region allowable radioactive contamination.

Key words: agro landscape, environmental sustainability, ecologically balanced use of land, the allowable area of contamination, transformation of agricultural land.